Energy Sources

Activity 1: Learning About Energy

Activity 2: Energy Talk--Part 1

Activity 3: Energy Talk--Part 2

ACTIVITY 1 **LEARNING ABOUT ENERGY SOURCES**

CONCEPT Energy sources can be classified in different ways.

GOAL Students will be able to site five new energy facts and terms related to forms and sources.

MATERIALS Items listed in bold type must be supplied by the teacher. Coal (charcoal briquette), oil (Lamp oil), **Oil Lamp (optional),** Bic® butane lighter, small vial filled with just air--this can be "natural gas"--put a match beside it to illustrate that it is an odorless, colorless gas but it is flammable*, solar cell, buzzer, **glass of water**, small piece of wood, **food (apple, orange, banana, etc.), electrical appliance (food mixer, tooth brush, hair blower, etc.)**, pinwheel, a "radioactive" sticker, 7 Energy Source complete posters, 7 sets of Energy Source poster puzzle pieces, **butcher paper, regular paper.**

*Natural gas has an additive called "Mercaptan" that gives it its distinctive odor. The smell is not harmful but it alerts a person that natural gas, which is odorless, is leaking. **Contact Public Service Company of Colorado, Judy Corrigan at (303) 294-2060, or Kathy Worthington at (303) 294-2284 to ask about Mercaptan "scratch and sniff" cards for your students.**

BACKGROUND

ENERGY FORMS*

There are seven **forms** of energy. Just remember the name: MRS CHEN.

M	Mechanical energy (kinetic energy); its counterpart is stored energy (potential energy)
R	Radiant energy or sunlight or solar
S	Sound energy
C	Chemical energy
H	Heat energy
E	Electrical energy
N	Nuclear energy

*Thanks to Rick Hanophy, Smiley Middle School, for the use of this model.

The **First Law of Thermodynamics** states that energy cannot be created or destroyed; it only changes form.

ENERGY SOURCES

Sources of energy, then, are materials or objects that produce energy by changing it from one form to another.

For example:

ENERGY SOURCE	CHANGES FROM THIS FORM...	TO THIS FORM
Solar Cell	Radiant	Electrical
Wind	Mechanical (kinetic--blades turning)	Electrical, Mechanical
Battery	Chemical (i.e. alkali battery)	Electrical
Space Heater	Electrical (outlet)	Heat, Mechanical (fan)
Gasoline	Chemical (combustion)	Mechanical, Heat, Sound
Oil, Coal, Nat'l Gas	Chemical (combustion)	Heat, Mechanical, Electrical
Food	Chemical (digestion)	Mechanical (muscles), Heat, Sound
Wood	Chemical (combustion)	Heat, Radiant, Sound

You can see that combustion (or burning) of an energy source gives us other forms of energy that our society uses every day. This is primarily why global warming has become an environmental problem in the last century. Combustion releases carbon dioxide which, in turn, traps heat in the lower atmosphere. Renewable energies such as solar cells and wind do not rely on combustion to produce the energy we use.

Oil, coal and natural gas are called *fossil fuels* because they come from plants and animals that have been buried for millions of years. The weight from mud and rock created pressure and heat that changed the plants and animals into fossil fuels. These energy sources are considered **nonrenewable** because once they are consumed, they are gone. It would take millions of years to produce more oil, gas, and coal.

Solar cells, wind turbines, biomass (plant material used to produce fuels), solar-thermal (sources that convert radiant to heat energy) are energy sources that can be reused because their primary source is the sun. Because the sun has an expected life span of 5 billion more years, these energies are considered **renewable**.

Since the sun has provided radiant light and heat to all living and nonliving things on the planet, it can be thought of as the primary source of both renewable and nonrenewable energies.

NOTE: Wind is not a *form* of energy so it's not found in MRS CHEN. Wind is a *source* of mechanical or motion energy.

FACTS ABOUT THE ENERGY EXAMPLES ON YOUR DEMO TABLE:

A. **COAL** (Charcoal briquette) Relate the use of this energy source to produce heat at a picnic or at home to cook hamburgers on a charcoal grill. Ask them if they have felt the heat energy released during the cooking. Point out that coal is a nonrenewable energy source. Once the charcoal is used up, no more hamburgers can be cooked.

B. **OIL** (Lamp oil and Bic® butane lighter) Some students may have experienced an oil furnace, but another way to illustrate oil as a source of energy is through the use of an oil lamp. Describe how they know this is an energy source - heat and light are produced during the burning process. Oil is also refined to produce gasoline (like butane). Point out that oil is a nonrenewable energy source because once the oil is used, the oil lamp will not provide any more light.

C. **RENEWABLE ENERGY**

Sunlight (Solar cell and buzzer) Introduce the term **solar energy**. Solar energy is energy derived from the sun. Show students the solar cell hooked to a buzzer. Shine a light (not fluorescent) on the cell to hear the buzzer. The sun is a renewable energy source.

Food (Apple or banana) Discuss why we take a break to eat lunch. (Food gives us energy to make it through the rest of the afternoon.) Point out that without adequate food we would be less active and eventually become weak or sick.

Water (Glass of water) Besides being used for a lot of other things, hydroelectric power plants use water to generate electricity. Falling water turns the plant's turbine generators. Water is also necessary to grow food and maintain all forms of life.

Wind (Pinwheel and blow dryer) Use the hair blower to make wind and observe the turning of the pinwheel. Point out that the moving air is the energy source. Does the wind have enough energy that it can push you around? Can the wind move a sailboat? Wind is a renewable energy source.

Wood or Biomass (Wood) Show the wood sample. Explain that when wood is burned in the fireplace, it warms the room. Point out that wastes are produced when this energy source is used - ash, smoke. Sometimes an energy source produces wastes.

D. **ELECTRICITY** (Hair blower, solar cell, lights) Electricity is a common form of energy. There are many sources of electricity--outlets, solar cells, batteries, etc. You can demonstrate that electricity is what makes the hair blower work. You can also demonstrate static electricity by scooting your feet on a carpet or combing someone's hair and watching it stand up.

E. **NATURAL GAS** (Empty bottle with match or Mercaptan card from Public Service) This form of energy is used a great deal in Colorado. Natural gas is formed under similar conditions as oil--from dead and decaying plant and animal life that lived millions of year ago in swampy, warm conditions. When drilling, gas is usually found in layers above oil since gas is lighter. Natural gas is piped to homes and is used to light stoves, heat water and run our furnaces. Some students may have gas fireplaces in their homes. Explain the additive, Mercaptan, that alerts people to the presence of harmful natural gas.

F. **NUCLEAR** (Radioactivity sticker) This energy comes from uranium fuel. Uranium ore occurs naturally underground and is mined and processed to remove Uranium 235. This is a radioactive material that is fissionable (its atoms can be split--a process that releases a lot of energy). Uranium 235 is processed into pellets and is loaded into a nuclear reactor of a nuclear power plant. The heat from fission is used to boil water. The steam turns a turbine which

generates electricity. Nuclear power plants face environmental problems because of the difficulty in disposing of nuclear waste.

ACTIVITY

INVITE

1. Have a display of each energy source sample on a table. Ask "Why do we need energy?" and list student responses on board. Use examples as hints such as “How can we use wood as a source of energy?” or “Why do we need gasoline (butane)?”

EXPLORE, DISCOVER

2. Using the Background Information above, work from the Demo Table and have students observe and talk about various energy sources using senses. [Sniff the Mercaptan cards, use hair blower to illustrate wind turning the pinwheel, handle a briquette to see the carbon smudges, the teacher should demonstrate the lighter, etc.]

CREATE

3. Distribute a 2' X 3' piece of butcher paper and 1 set of Energy Source Jigsaw pieces to each group of 3 or 4 students. Challenge each work group to put their puzzles together. You can put the complete set of posters up around the room to use as a guide.

4. Tape the pieces together onto the butcher paper.

APPLY NEW KNOWLEDGE

5. On a separate piece of paper, have each group come up with five (5) facts or 5 NEW vocabulary words from their poster.

TAKE ACTION

6. Give each student group about 3-4 minutes to share with the class their list of facts and words. Challenge them to make meaning of some of the words. Ask them to find something on the Demo Table that applies to their poster and list of facts.

FOLLOW UP/ASSESSMENT OPTION

1. Have students list all the energy forms and sources they have used that day (electricity to run the radio, light the lights, natural gas to heat the house and hot water, gas/oil in the bus to come to school, food to run and play, etc.) See who has used the greatest variety of energy sources (use the posters for help.)

2. Take away the Coal, Oil and Natural Gas Posters. Have students re-create their day without using these energy sources. Explain that this most likely will be the energy challenge in their future. (They can use the sun for heat, electricity (solar cell) and even for buses!)

LEAVE THE DEMO TABLE SET UP FOR ACTIVITY 2.

Activity 2 **ENERGY TALK -- PART I**

CONCEPT Each energy source (coal, sun, etc.) can be used in many ways.

GOAL Students will be able to identify energy sources as renewable or nonrenewable.

MATERIALS Items listed in bold type must be supplied by the teacher. Demo Table from Activity 1, energy source vocabulary words--**cut into strips**.

BACKGROUND
The following chart provides additional information on the classification of energy sources. You can use it to add to the Demo Table and to make a more challenging activity by having students consider other energy sources.

RENEWABLE ENERGY SOURCE USES				
SUN (Solar cell)	**WIND (Dryer)**	**WATER**	**FOOD**	**WOOD**
homes buildings plants heat light electricity	sailboats boats windmills electricity	waterwheels dams electricity	animals people plants	stoves factories electricity buildings heat light paper
NONRENEWABLE ENERGY SOURCE USES				
COAL	**OIL (Lamp oil)**	**NUCLEAR (Radioactive sticker)**	**NATURAL GAS**	**GASOLINE (Butane lighter)**
electricity trains	furnaces electricity grease for cars	heat buildings electricity	heat electricity	cars trucks boats lawnmowers

ACTIVITY
INVITE
1. Display the energy source samples again. Review the different sources of energy represented on the table: briquette = coal; solar cell = sun; lamp oil = oil; butane lighter = gasoline; pinwheel = wind, etc.

DISCOVER, INTRODUCE NEW VOCABULARY/CONCEPTS
2. Ask students what they do when they check out a book from the library but don't finish reading it. What can they do? [Answer: renew it.] Explain that some of the energy sources on the table can be used over and over again--they don't "run out"--they can be renewed like a library book.

3. Ask students to think about which items from the table could be reused. Explain that charcoal will burn to ashes, the oil lamp will burn up all the oil, that natural gas will be burned up. Once it's gone, it can't be used again for energy. Show them the solar cell and ask, "What does this need to work?" [sun] Then ask, "Can we reuse the sun? [Yes.] Will it run out? [No.]

[Technically, yes. The sun will last about 5 billion more years before exploding to a red giant, then collapsing to a white dwarf. But, for our lifetimes, the sun is considered renewable.]

4. Put the following headings on the board. Have students look at the Demo Table and classify the energy sources. Challenge them to come us with additional examples.

RENEWABLE ENERGY	**NONRENEWABLE ENERGY**
[glass of water]	[charcoal]
[solar cell]	[lamp oil]
[wood]	[natural gas]
[food]	[radioactive-nuclear]
[hair blower/wind]	[butane lighter]

Note: The electricity that powers the hair blower is coming from a nonrenewable energy source--coal-fired power plants. However, a hair blower can be run from other electricity sources such as solar cells.

Additionally, you can make a wall chart with definitions of Renewable/Nonrenewable Energy. Put up the Energy Posters as well. Then have students fill in examples of advantages and disadvantages:

Energy Source	Advantages	Disadvantages

BRAINSTORM SOLUTIONS/APPLY NEW KNOWLEDGE

5. Tell students you are going to read part of an energy poem. Cut the stanzas apart and put in a cup. Have a student draw one out. Read it and let students identify the energy source. Then ask "Is it renewable or nonrenewable?" "How do you know?"

6. Read one or two more stanzas, however, read only one line at a time until students can guess the source. Be sure they can classify whether it is renewable or nonrenewable. [Use this as a way to check for understanding before moving on to #7.]

7. Divide students into pairs. Each pair should have a sheet of paper and a pencil. Fold the paper in half lengthwise and cut or tear in half. Have students draw an Energy Source Vocabulary strip. When each group has a strip, have them turn the strip face up and give them 1 minute to brainstorm as many clues about their energy source as they can. The clues must be written on one half sheet of paper. Challenge students to come up with clues that aren't "dead giveaways." [You may want to make copies of the poem "Helping Hand" for each pair.]

8. After 1 minute, collect strips, and give each pair a new word. Give them another minute. Have them write a new set of clues on the other half sheet of paper. Collect the vocabulary strips after 1 minute.

PRESENT FINDINGS TO CLASSROOM

9. Have student groups read their clues to the class. The class must guess the energy source and whether it is renewable or nonrenewable. Have them tape their papers to the board according to the correct category (renewable or nonrenewable). See how many clues it takes to identify each energy source.

10. Ask "Why are some sources identified quickly while others take more clues?" And "What clues are the same for more than one energy source?" ['I give heat and light' is a clue that can describe the sun, wood burning, oil burning, coal burning, etc.]

ASSESSMENT OPTIONS

11. Have each student write a 'Helping Hand' poem about energy sources that is at least 5 stanzas.

12. Have students design an "Imaginary Ultimate Energy Source" that is renewable and can light/heat our homes and schools, run our cars, can be eaten and won't pollute.

“Helping Hand”

I am used in cars.
I am a liquid.
I come from crude oil.
People pump me through a hose.
Cars and trucks need me to run.
People use too much of me.
Who am I?

I am black and shiny and hard.
I am burned for heat.
People mine for me deep in the ground.
I am very old!
I come from ancient plants.
Who am I?

I give heat and light.
I make the day warm.
I help plants to grow.
It is dark when I am not around.
Who am I?

I am very wet.
People use my energy through dams so I can make electricity.
I am good to drink.
I cool you in summer and help to keep you clean.
Who am I?

You like me!
I give you energy.
You can find me in the grocery store or in a garden.
You need me to grow.
Who am I?

I am so important!
I am used in many things.
People burn me in a fireplace to keep them warm.
I make lovely furniture, and I am used to build houses.
Who am I?

Light bulbs need me.
Without me, computers will not work.
I am a "powerful" thing!
I am a form of energy.
Who am I?

Gasoline is made from me.
Some people use me to heat their homes.
I can fix a squeaky door

Who am I?

[Answers: gasoline, coal, sunlight, water, food, wood, electricity, and oil.]

Activity 2
ENERGY TALK -- PART I
Vocabulary Cards

gasoline	**gasoline**	**gasoline**
coal	**coal**	**coal**
solar	**solar**	**solar**
water	**water**	**water**
food	**food**	**food**
wood	**wood**	**wood**
electricity	**electricity**	**electricity**
oil	**oil**	**oil**
natural gas	**natural gas**	**natural gas**
wind	**wind**	**wind**

ACTIVITY 3 **ENERGY TALK -- PART II**

CONCEPT Energy sources can be classified into two different categories: renewable and nonrenewable.

GOAL Students will color pictures of, read about, and classify energy sources.

MATERIALS Items listed in bold type must be supplied by the teacher. Energy Source Flash Cards, Flash Cards Factsheets, **crayons or colored pencils, glue sticks, scissors,** Demo Table from Activity 1, construction paper for booklet covers, string.

ACTIVITY

INVITE

1. Have students cut out all 10 Energy Source Flash Cards and color them.

2. Check for understanding by having a student match an energy source from the Demo Table to one of the cards. Again, have them classify the source as renewable or nonrenewable.

GATHER INFORMATION

3. Distribute a set of Flash Cards Factsheets to each student. Have them cut out each card.

4. Tell students to read the information on the factsheet (or read as a class). Have them match the factsheets to each of the pictures they have just colored. Check for accuracy.

5. Using a glue stick, glue the factsheet to the back of the correct picture. Let it dry.

ANALYZE DATA, APPLY NEW KNOWLEDGE

6. Pair students and have them face each other with their cards held out of sight.

ROUND ONE

7. One student shows the energy picture to his/her partner. The partner must identify whether the source is renewable or nonrenewable. If the student is correct, the card is placed aside and they switch. Play continues until both students have placed all cards aside.

ROUND TWO

8. One student shows the energy picture to his/her partner. The partner must give one energy fact relating to that energy source. If the student is correct, the card is placed aside and they switch. Play continues until both students have placed all cards aside.

ROUND THREE

9. One student verbally gives a clue about an energy source [use, advantages, disadvantages, etc] to his/her partner. The partner tries to guess what the energy source is.

TAKE ACTION

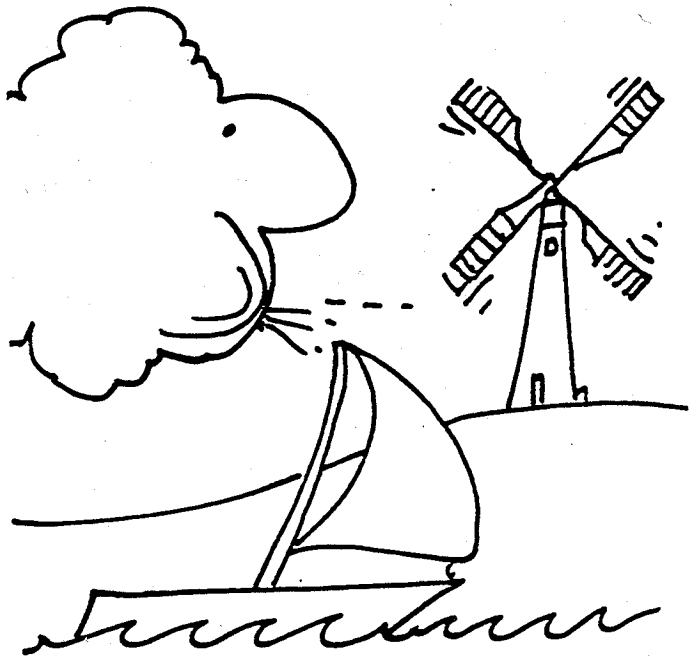
10. Make a book out of the 10 cards and classify them into renewable, nonrenewable energy sources. Create a cover for the book and include a title.

Note: Nuclear is sometimes considered to be renewable even though fuel pellets are nonrenewable. The supply of nuclear fuel is considered limitless. However, the environmental problems associated with nuclear energy [disposal of wastes, radiation leaks] make it more of a nonrenewable energy source. Electricity is really neither a renewable or nonrenewable energy source, but an energy form derived from either a renewable or nonrenewable energy source.

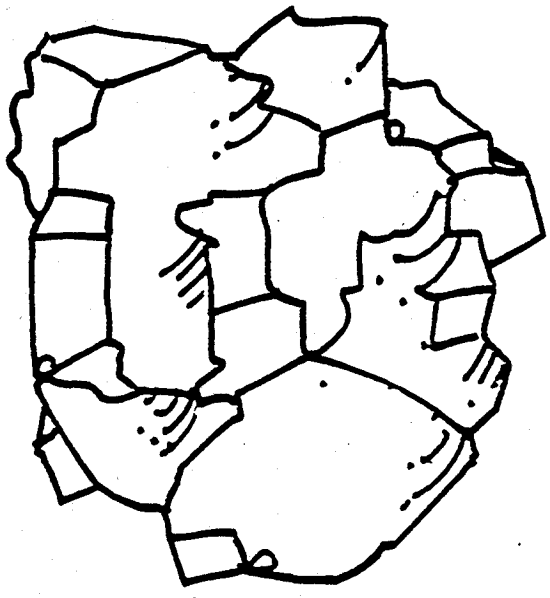
Energy Source Flashcards

Name _____

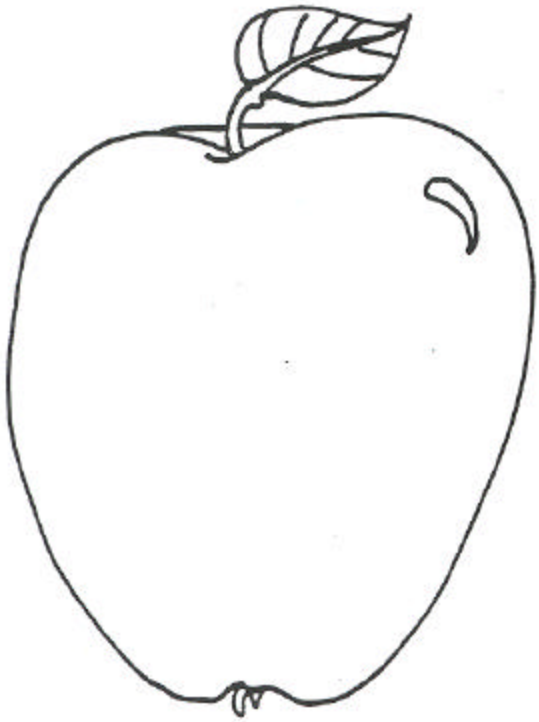
Date _____



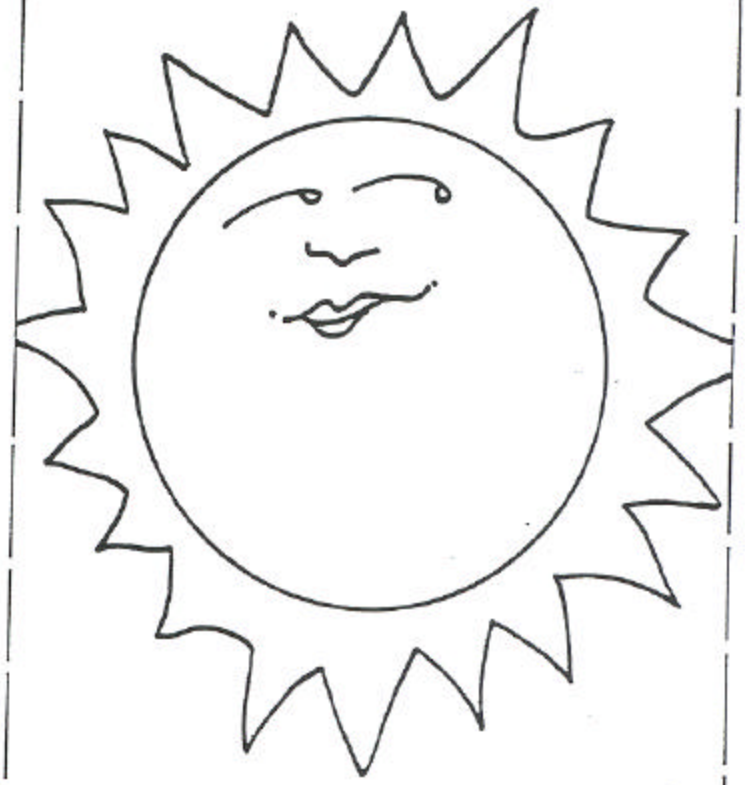
Wind



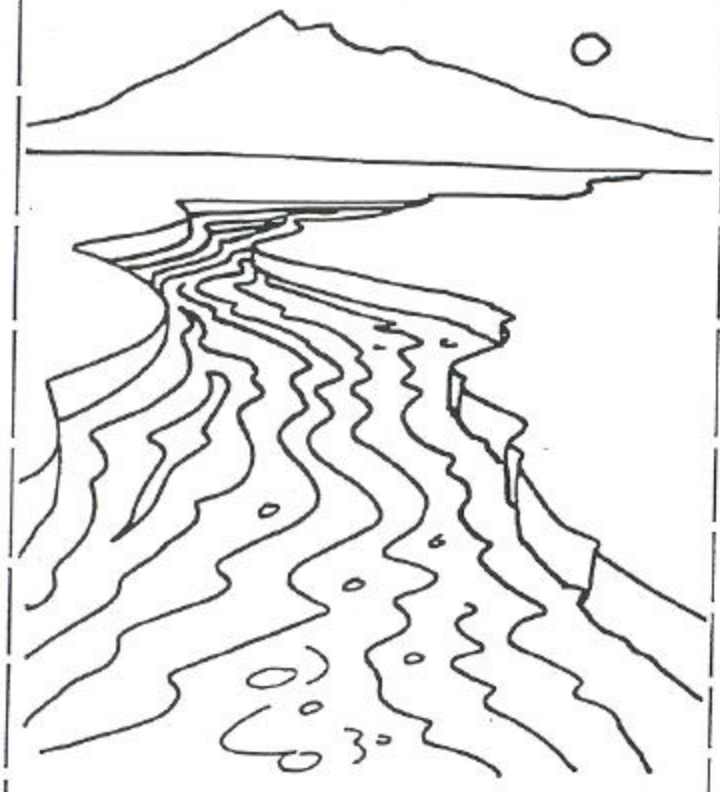
Coal



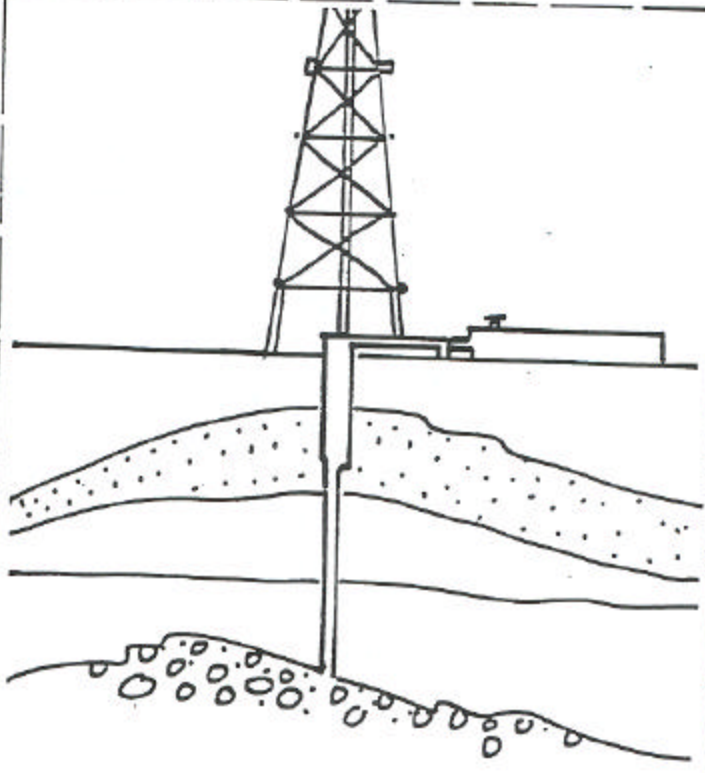
Food



Sun

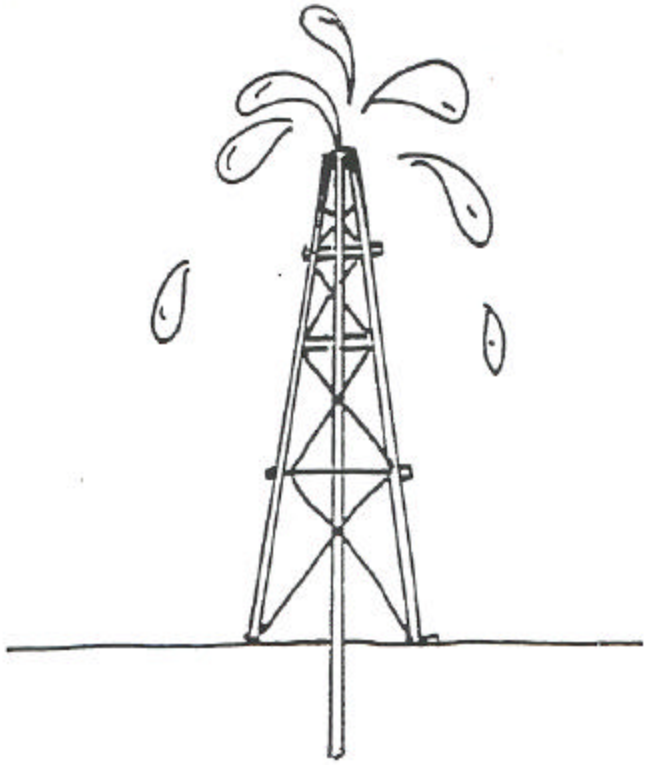


Moving Water

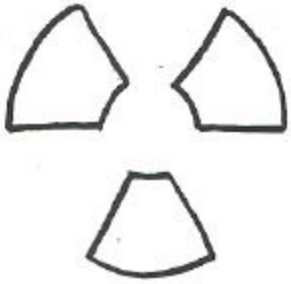


Natural Gas

Wood



Oil



CAUTION
X-RAYS

Nuclear

Electrical

Activity 3 -- ENERGY TALK FACTSHEETS

Renewable Energy Source

- moving air created when the sun heats the Earth unevenly
- turns blades on wind-turbines to make electricity

Advantage

- clean energy, no pollution

Disadvantage

- you must wait for the wind to blow

Nonrenewable Energy Source

- formed from animals and plants that died millions of years ago
- the most commonly used energy source for electricity

Advantage

- cheap, available now

Disadvantages

- when burned, it pollutes air and water
- leaves smudges when held
- scars landscape when mined

Renewable Energy Source

- necessary for living things
- helps you to grow, move, think
- requires clean water and air to grow properly

Advantages

- tastes good, is good for you
- can be grown fairly easily with proper soil, water, air

Disadvantages

- too many sweets, fats can be harmful
- can't be grown successfully everywhere on Earth

Renewable Energy Source

- the only star in our solar system
- maintains life on our planet
- energy takes 8 minutes to reach our planet

Advantages

- convenient source of energy
- free

Disadvantages

- it isn't available 24 hours a day
- clouds, weather
- skin cancer

Renewable Energy Source

- falling water turns blades on turbines to make electricity
- also called hydropower
- supplies 8% of U.S. energy

Advantage

- can supply electricity to large areas

Disadvantages

- seasonal changes in water flow
- disturbs life in rivers that are dammed
- not many rivers left to use

Nonrenewable Energy Source

- formed from animals and plants that died millions of years ago
- gas forms above oil deposits deep in the Earth
- also forms in landfills
- can be used for fuel

Advantages

- burns cleaner than coal or oil
- large supply in the U.S.

Disadvantages

- adds heat and carbon dioxide to the air
- difficult to move long distances

Renewable Energy Source

- used mostly for paper and building supplies
- wood pulp from lumber mills is now recycled into cardboard and paper
- along with other crops, it can be made into gasolines and fuels

Advantages

- can be used for a large variety of things
- convenient, easy to use
- can take the place of today's gasoline

Disadvantages

- forests are clear-cut
- when burned, it adds heat and carbon dioxide to the air
- pollutes the water when it is made into paper

Nonrenewable Energy Source

- forms from animals and plants that died millions of years ago
- is found deep in the Earth
- drilling rigs are on land and out in the ocean

Advantages

- there is a large source now available
- it is easily moved from where it's drilled to where it's used
- can be made into many kinds of fuels (lamp oil to diesel)

Disadvantages

- drilling disturbs valuable wildlife habitat
- oil spills
- U.S. depends on foreign countries to sell us the oil
- it pollutes the air when burned

Nuclear

- uses uranium pellets in reactors
- to make electricity
- is used in the northeast and north-
- west sections of the U.S.

Advantages

- can produce a lot of electricity with a little bit of fuel
- power plants don't pollute the air

Disadvantages

- reactors have had accidents where radioactive materials get into the air, water and soil
- the waste from a reactor takes millions of years to decompose to safe levels of radiation
- there are few places to store the radioactive waste

Renewable and Nonrenewable Energy Form

- the only one of these cards that is an energy FORM (not a source)
- it is energy made of tiny moving particles called electrons
- is one of the most common forms of energy that humans use

Advantages

- convenient and easy to use
- can be used for a lot of different things
- can be moved over long distances
- is clean energy if it is produced by solar cells or wind turbines

Disadvantages

- if not used properly, it can kill
- can pollute the air if electricity is produced by burning coal or oil